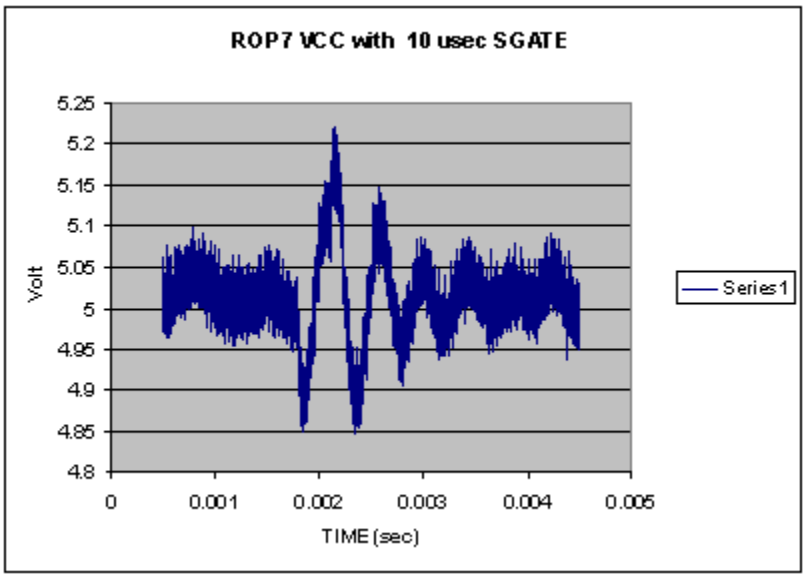
(Excerpt from MINOS internal document on implementing filter capacitors on the 9U MASTER Crate backplanes.)

VOLTAGE TRANSIENT

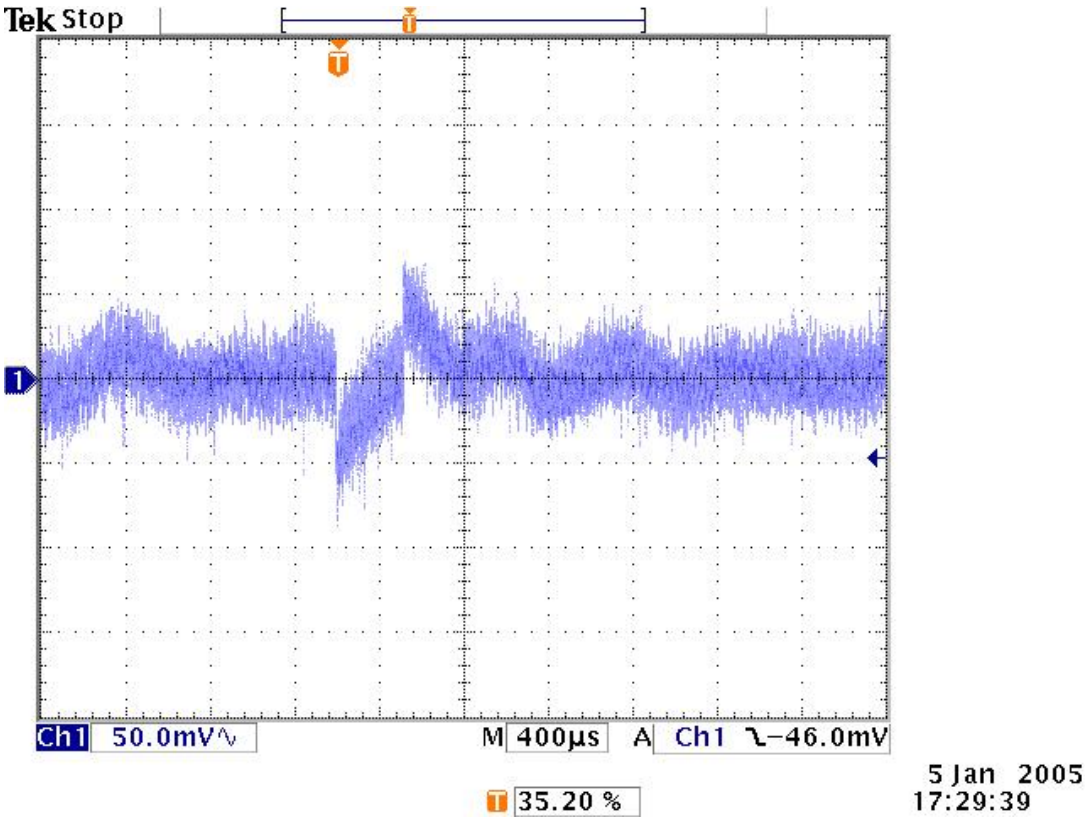
For up to 18μs gate around the NuMI beam spill, a data word is stored for each of the 9352 channels of the Near Detector front end. At the end of the spill gate, the data are transferred to the MASTER crates during a time equal in duration to 32 times the spill gate.

As data are processed through the MASTER cards, the current draw on the +5V increases from approximately 50 amps for a full crate to 62 amps. The WIENER power supply regulation mostly keeps up with this change in demand, except for an approximately +250mV/-100mV transient, as shown below. This transient causes the VME processors in some of the crates to shut down as a protective measure.



The typical remaining transient with the 2 100 mF capacitors in parallel with the +5 V is shown below. No problem with the VME processors is observed during spill gate readout with the capacitors installed. Based on the 50 A quiescent current at 5 V, we estimate the representative resistance

between 5V and ground to be 100mΩ. The estimated peak current being serviced by the capacitors during this time, based on the transient that they eliminate, is approximately 2.5A. The transient occurs over approximately 580 ms, and is repeated every NuMI spill, or every 1.9 seconds.



MODIFICATION

Capacitors

Two 100mF large-can, 16V capacitors will be added to each MASTER crate, in parallel with the +5V. The capacitors are United Chemi-Con part number 36DA104F016AD2A, described in the attached specification sheet. The lifetime rating of the capacitor is 2000 hours at 85C, but the MASTER rack protection system has a hardware trip set at 50C, and the operating temperature is less than 40C.

UNITED CHEMI-CON

TECHNICAL DATA SHEET

CUSTOMER:
CUSTOMER PN:
UCC PN: 36DA104F016AD2A
UCC MAXCIM NO.: 36594

ELECTRICAL CRITERIA

CAPACITANCE (120Hz/25°C):	100000 µF
CAPACITANCE TOLERANCE:	-10/+50 %
RATED VDC	16 V
SURGE VDC (30 sec):	20 V
MAX. ESR (120Hz/25°C):	13.6 mΩ
MAX. IRMS (120Hz/85°C):	11.4 A
MAX. DCL (VDC/5:00/25°C):	5.060 mA

MECHANICAL CRITERIA

MAX. VIBRATION:	10-55Hz 10 g
TERMINAL THREAD	10-32
THREAD DEPTH	5.6 mm
MAX. TERMINAL TORQUE:	2 Nm
TYP. WEIGHT:	162 grams

OPERATING CRITERIA

MAX. TEMPERATURE:	+95 °C
MIN. TEMPERATURE:	-40 °C
LOAD LIFE (VDC/85°C):	2000 Hrs
MAX. Δ CAP. (measured value):	± 15 %
MAX. ESR (specified value):	≤ 150 %
MAX. DCL (VDC/5:00/25°C):	5.060 mA
SHELF LIFE (85°C):	500 Hrs
MAX. Δ CAP. (measured value):	± 15 %
MAX. ESR (specified value):	≤ 120 %
MAX. DCL (VDC/5:00/25°C):	10.120 mA

IRMS FREQUENCY MULTIPLIERS

VDC	120Hz	400Hz	>1kHz
0-50	1.00	1.05	1.10
51-100	1.00	1.10	1.15

IRMS AMBIENT MULTIPLIERS

55°C	65°C	75°C	85°C
2.0	1.7	1.4	1.00

SPECIAL

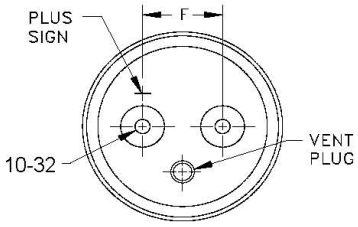
ISSUE: 1 DATE: 2/2/00

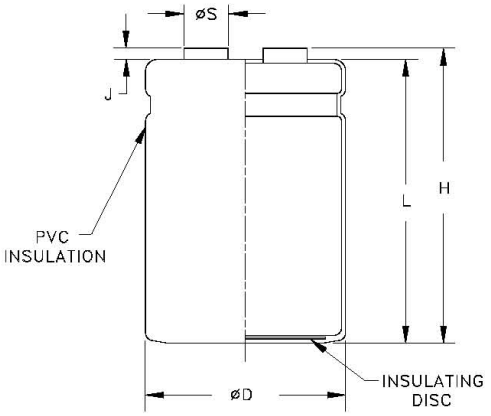
DIMENSIONAL CRITERIA

	mm		X in
øD	1.375	- 0.00	+ 0.040
L	4.625	- 0.00	+ 0.080
H	4.719	- 0.08	+ 0.080
F	0.500	- 0.02	+ 0.016
J	0.063	- 0.04	+ 0.040
øS	0.313	- 0.01	+ 0.010

MARKING

36DA 95°C
100000uF 16V
Date Code
+ positive





TDS NO.: TDS-05-0018
AUTHOR: TMASH
DATE: 12-JAN-05

Location

The capacitors are placed inside an enclosed volume at the rear-top of the MASTER crates. This volume is used for routing internal insulated power lines between the external crate power lugs and the internal bus bars, and the routing of the sense line bundle between the external crate connector and the crate backplane. Since the volume is behind the crate backplane, the capacitors do not block airflow past active electronics components in the crates – only passive signal auxiliary cards are below the volume. The following photograph shows the placement of the capacitors in the volume, with the volume cover temporarily removed.